

REMARKS

This Reply is in response to the Office Action mailed on November 29, 2007 in which claims 10, 11, 20, 30 and 40 were withdrawn from consideration and in which claims 1-9, 12-19, 21, 25-29, 31-39 and 41-55 were rejected. With his response, claim 50 is canceled and claims 18, 49, 51-52 and 55 are amended. Claims 1-9, 12-19, 21, 25-29, 31-39, 41-49 and 52-55 are presented for reconsideration and allowance. Reinstatement of withdrawn claims 10, 11, 20, 30 and 40 is further requested.

I. Objection to the Drawings

Section 2 of the Office Action objected to the drawings by asserting that the limitations of claims 2 and 28-29 are not shown in the drawings. This is incorrect.

Claims 2 and 28-29 and recites fitting a negative in the interconnect over a projection. Claims 2 and 28-29 are each amended to further recite that the negative receives at least partially surrounds the projection.

Figure 12 illustrates device 302 having an interconnect 602 having a negative 802 (the reference number for the negative 802 can be seen in Figure 8. The orienting and fitting can be seen in Figures 5 and 6. Accordingly, the objection to the drawing should be withdrawn.

II. Objection to the Abstract

Sections 3 and 4 objected to the Abstract. In response, the Abstract is amended. The Abstract is now believed to provide a concise statement of the technical disclosure. Applicants respectfully note that there is no minimum requirement for the number of words in an abstract. Accordingly, Applicants respectfully request that the objection to the abstract be withdrawn.

III. Rejection of Claims 18-19, 21 and 44-48 under 35 USC 112, Second Paragraph

Section 6 of the Office Action rejected claims 18-19, 21 and 44-48 under 35 USC 112, second paragraph as being indefinite. In particular, the Office Action asserted that "the other of

..." in each of such claims lacks antecedent basis. Apparently, the Examiner is unfamiliar with this well-known claim format wherein the claim recites "one of X and Y" and later recites "the other of X and Y" to cover the mere reversal of parts. Although Applicants believe that the original claim format is correct, each of the claims is now amended to alternatively change "the other" with --an other --. Accordingly, claims 18-19, 21 and 44-48, as amended, overcome the rejection under 35 USC 112, second paragraph. Since this is the only rejection of claims 18-19 and 21, claims 18-19 and 21 are believed to be in condition for allowance. Reinstatement of withdrawn claim 20, which depends from claim 18, is also requested.

IV. Rejection of Claims 1-7 and 15-17 under 35 USC 102(e) Based upon Eichelberger

Section 8 of the Office Action rejected claims 1-7 and 15-17 under 35 USC 102(e) as being anticipated by Eichelberger et al. US Patent 6555908. For the reasons which follow, this rejection should be withdrawn.

A. Claim 1

Claim 1 recites a method which includes pressing an interconnect to a dense circuit device using a substrate, wherein the act of compressing comprises mechanically clamping the interconnect between the dense circuit device and the substrate.

Eichelberger fails to disclose pressing an interconnect to a dense circuit device using a substrate by mechanically elamping the interconnect between the dense circuit device and the substrate. In contrast, Eichelberger merely discloses a multi-layer polymer bump module 1000 which is soldered to a printed circuit board 1300.

In rejecting claim 1, each of claims or 1-7 and 15-17 days upon Eichelberger, the Office Action simply provides an annotated copy of the disclosure of Eichelberger. In order to reject the claims, the Office Action attempts to characterize some of the layers of the unitary multilayer module 800 as the recited interconnect and other layers of the unitary multilayer module 800 as the dense circuit device.

However, this characterization is improper. Although an examiner may be allowed to apply the broadest reasonable interpretation to a claim, this characterization amounts to a distortion of the English language. Claim 1 recites that the interconnect is "pressed to the dense circuit device." One of ordinary skill in the art would never consider layers which are formed upon one another as being "pressed" towards one another.

More importantly, claim 1 recites that the interconnect is "mechanically clamped between the dense circuit device and the substrate." The definition of the verb clamp is "to fasten with or fix in a clamp". Random House College dictionary (1984). The definition of a clamp is;

1. A device for strengthening or supporting objects or fastening them together.
2. An appliance with opposite parts that may be brought closer together to hold or compress something.

(Random House College dictionary (1984)).

One of ordinary skill in the art would never consider an underlying layer of a multi-layer structure as being "mechanically clamped" between an overlying layer of the multilayer structure and another structure. The Examiner's argument is analogous arguing that the jelly layer of a peanut butter and jelly sandwich is "mechanically clamped" between the peanut butter and the bread. This characterization fails to hold water. Accordingly, rejection of claim 1 should be withdrawn. The rejection of claims 2-7 and 15-17, which depend from claim 1, should be withdrawn for at least the same reasons.

B. Claim 2

Claim 2 depends from claim 1. Claim 2, as amended, recites fitting a negative in the interconnect over a projection on the dense circuit device such the negative receives and at least partially surrounds the projection. Support for this amendment may be found in at least Figure 12.

Eichelberger fails to disclose fitting a negative in an interconnect over a projection on the dense circuit device such that the negative receives at least partially surrounds a projection. In the annotated Figure 13C of Eichelberger provided in the Office Action, the Examiner refers to two layers of the multilayer module 800 as the alleged projection and negative. It is clear that the alleged negative pointed to in the Figure 13C by the Office Action does not receive and at least partially surround the alleged projection pointed to in the Figure 13C by the Office Action. Accordingly, claim 2, as amended, overcomes the rejection based upon Eichelberger.

C. Claim 3

Claim 3 depends from claim 1 and recites that the active orienting comprises orienting WIRES of the interconnect with the electrical bond pads of the dense circuit device.

Eichelberger fails to disclose any wires. In contrast, Eichelberger merely discloses electrically conductive layers of a multilayer module 800. A wire is defined as "a slender, stringlike piece or filament of metal." (Random House College dictionary (1984)). An electrically conductive layer or electrically conductive traces is not a wire. One of ordinary skill in the art would not consider an electrically conductive layer of a multilayer structure to be a "wire." Accordingly, the rejection of claim 3 should be withdrawn. The rejection of claims 4-8 which depend from claim 3 should be withdrawn for at least the same additional reasons.

D. Claims 4-7 and 15

Claims 4-7 depend from claim 3 and recite various ranges of dimensions with respect to the overlap of the wires end of the electrical bond pads. Claim 15 depends from claim 1 and recites that the dense circuit device has a length a width of less than or about 25 mm. As noted in the present application, one of the problems being solved by the present method is the usual difficulty of forming interconnections when dense circuit devices and the electrical bond pads become small. (See Paragraph [0003]). Applicants' method addresses the noted problem, potentially enabling these more compact or smaller arrangement of devices to be achieved.

Eichelberger fails to disclose the recited dimensions for the overlap between the electrical bond pads and wires. Eichelberger fails to disclose the recited in dimensions for the dense circuit device. Applicants respectfully note that anticipation requires a reference to disclose each and every claimed element. Nowhere does Eichelberger even remotely mention any ranges of dimensions for such overlap or the dense circuit device. As a result, such claims cannot be anticipated by Eichelberger.

In rejecting claims 4-7, the Office Action points to structures in the annotated Figure 13C of Eichelberger with the notation "not drawn to scale." This does not establish a prima facie case of anticipation with regard to a claimed dimension. If such were the case, nearly every patent claim reciting a dimension would be invalid. The rejection of claims 4-7 as being anticipated by Eichelberger is improper and should be withdrawn.

V. Rejection of Claim 8 under 35 USC 103(a) Based upon Eichelberger and "Official Notice".

Section 10 of the Office Action rejected claim 8 under 35 USC 103(a) as being anticipated by Eichelberger et al. US Patent 6555908 in view of "Official Notice." Claim 8 depends from claim 3 and overcomes the rejection for the same reasons discussed above with respect to the rejection of claim 3 based upon Eichelberger alone.

VI. Rejection of Claims 9, 12-14, 25-29, 31-39 and 41-43 under 35 USC 103(a) Based upon Eichelberger and Tong

Section 11 of the Office Action rejected claims 9, 12-14, 25-29, 31-39 and 41-43 under 35 USC 103(a) as being unpatentable over Eichelberger et al. US Patent 6555908 in view of Tong et al. US Patent 6962835. For the reasons that follow, such rejections should be withdrawn.

A. Claims 9 and 12-13

Claims 9 and 12-13 depend from claim 1 and overcome the rejection for the same reasons discussed above with respect to the rejection of claim 1 based upon Eichelberger alone. Tong fails to satisfy the deficiencies of Eichelberger.

Moreover, claim 1, from which claims 9 and 12-14 depend, additionally recites that the substrate is bonded to the dense circuit device. Claim 9 recites that this bonding is covalent bonding. Claim 12 recites that this bonding is performed at low temperature. Claim 13 recites that this bonding is performed at room temperature.

Neither Eichelberger nor Tong, alone or in combination, disclose the use of covalent bonding, bonding at a low temperature or bonding at room temperature of a substrate to a dense circuit device. Although it may be true that Tong broadly discloses covalent bonding. Tong does not disclose covalent bonding of a substrate to a dense circuit device with an interconnect also located between the dense circuit device and the substrate.

Even assuming, arguendo, that it would be obvious to modify Eichelberger based on Tong to use a covalent bonding taught by Tong, the resulting hypothetical combination would still not result in a method in which the dense circuit device of Eichelberger would be covalently bonded, bonding at low temperature or bonding at room temperature to the substrate. At most, the resulting hypothetical combination would simply involve covalently bonding what the Office Action characterizes as the interconnect to what the Office Action characterizes as the substrate. Accordingly, the rejection of claims 9 and 12-13 should be withdrawn for least this additional reason.

B. Claim 14

Claim 14 depend from claim number one and recites covalently bonding wires of the interconnect with electrical bond pads of the dense circuit device.

Once again, Eichelberger does not disclose any wires. Likewise, Tong does not disclose any wires. Accordingly, the rejection of claim 14 should be withdrawn.

C. Claim 25

Claim 25 recites a method which includes providing a dense circuit device having a first surface, a substrate having a second surface and mechanically clamping an interconnect between the dense circuit device and the substrate by covalently bonding the first surface and the second surface.

Neither Eichelberger nor Tong, alone or in combination, disclose or suggest a method (1) wherein a surface of a dense circuit device is covalently bonded to surface of a substrate or (2) wherein an interconnect is mechanically clamped between the dense circuit device and the substrate.

First, nowhere does Eichelberger even remotely suggest that the upper layers of the multilayer module 800 that have been characterized by the Office Action as the "dense circuit device" have a surface that is bonded to printed circuit board 1300 (characterized by the Office Action as the "substrate"). Nowhere does Eichelberger even remotely suggest that such bonding would be reform by covalent bonding. In contrast, the portion of the multilayer module 800 of Eichelberger characterized as the dense circuit device never even comes close to touching circuit board 1300.

Second, nowhere does Eichelberger or Tong even remotely suggest an interconnect that is mechanically clamped between the dense circuit device and the substrate. As noted above with respect to the rejection of claim 1 based upon Eichelberger, one of ordinary skill in the art would never consider an underlying layer of a multilayer structure to be mechanically clamped with respect to an overlying layer of a multilayer structure. Accordingly, the rejection of claim 25 should be withdrawn. The rejection of claims 26-29 and 31-39 and 41-43 which depend from claim 25 should be withdrawn for least the same reasons.

B. Claims 28 and 29

Claim 28 and 29 depends from claim 25. Claims 2829, as amended, recite fitting a negative in the interconnect over a projection such that the negative receives the projection and at least partially surrounds a projection.

Neither Eichelberger nor Tong, alone or in combination, disclose or suggest fitting a negative in an interconnect over a projection such that the negative receives at least partially surrounds a projection. In the annotated Figure 13C of Eichelberger provided in the Office Action the Examiner refers to two layers of the multilayer module 800 as the alleged projection and negative. It is clear that the alleged negative pointed to in the Figure 13C by the Office Action does not receive and at least partially surround the alleged projection 22 in the Figure 13C by the Office Action. Accordingly, claim 28 and 29, as amended, overcome the rejection based upon Eichelberger and Tong.

C. Claim 31

Claim 31 depends from claim 25 and recites that the active orienting comprises orienting wires of the interconnect with electrical bond pads of the dense circuit device.

Neither Eichelberger nor Tong, alone or in combination, disclose orienting wires of an interconnect with electrical bond pads of a dense circuit device. As noted above, Eichelberger does not disclose any wires. Moreover, the electrically conductive layers of the multilayer module 800 which happen to be adjacent to other electrically conductive layers of the multilayer module 800 does not constitute orienting wires with electrical bond pads. Accordingly, rejection of claim 31 should be withdrawn for least this additional reason.

D. Claim 32-33

Claims 32 and 33 depend from claim 31 and further recite a range of dimensions in which the wires and the bond pads overlap one another. As noted in the present application, one of the problems being solved by the present method is the usual difficulty of forming interconnections when dense circuit devices and the electrical bond pads become small. (See Paragraph [0003]).

Applicants' method addresses the noted problem, potentially enabling these more compact or smaller arrangement of devices to be achieved.

Neither Eichelberger nor Tong disclose the recited dimensions for the overlap between the electrical bond pads and wires. Accordingly, their combination does not disclose the recited dimensions.

In rejecting claims 32 and 33, the Office Action points to structures in the annotated Figure 13C of Eichelberger with the notation "not drawn to scale." This does not establish a prima facie case of obviousness with regard to a claim dimension. If such were the case, nearly every patent claim reciting a dimension would be invalid. The rejection of claims 32 and 33 days upon Eichelberger and Tong is improper and should be withdrawn.

E. Claims 35-36

Moreover, claim 25, from which claims 35 and 36 depend, additionally recites that the substrate has a surface that is bonded to a surface of the dense circuit device. Claim 35 recites that this bonding is performed at low temperature. Claim 36 recites that this bonding is performed at room temperature.

Neither Eichelberger nor Tong, alone or in combination, disclose bonding at a low temperature or bonding at room temperature of a surface of a substrate to a surface of a dense circuit device. Although it may be true that Tong broadly discloses covalent bonding, Tong does not disclose covalent bonding of a substrate to a dense circuit device with an interconnect also located between the dense circuit device and the substrate.

Even assuming, arguendo, there would be obvious to modify Eichelberger based on Tong to use a covalent bonding taught by Tong, the resulting hypothetical combination would still not result in a method in which the dense circuit device of Eichelberger would be bonded at low temperature or bonded at room temperature to the substrate. At most, the resulting hypothetical combination would simply involve covalently bonding what the Office Action characterizes as

the interconnect to what the Office Action characterizes as the substrate. Accordingly, the rejection of claims 35 and 36 should be withdrawn for least this additional reason.

F. Claim 37

Claim 37 depends from claim 25 and recites formation client layer between the interconnect and the substrate.

Neither Eichelberger nor Tong, alone or in combination, disclose or suggest forming a compliant layer between the interconnect in the substrate. In rejecting claim 37, the Office Action refers to its annotated Figure 13C and attempts to characterize a layer of circuit board 1300 as the claimed "compliant layer." First, nowhere does Eichelberger disclose that the portion pointed to by the Office Action is compliant. Second, this portion of circuit board 1300 characterized by the Office Action as the "compliant layer" is NOT between circuit board 1300 (characterized as a substrate) and those portions of multilayer module 800 (characterized by the Office Action as the interconnect). Rather, it is actually part of circuit board 1300. Accordingly, the rejection of claim 37 should be withdrawn for least this additional reason.

G. Claim 38 and 39

Claim 38 and 39 depend from claim 25 and recite that the interconnect includes a compliant layer.

Neither Eichelberger nor Tong, alone or in combination, disclose or suggest the interconnect of claim 25, wherein the interconnect includes a compliant layer. The portion pointed to in the annotated Figure 13C of the Office Action and characterized by the Examiner as the "compliant layer" is not even asserted as being part of the alleged interconnect. Accordingly, the Office Action has failed to establish even a prima facie case of obviousness with regard to claims 37 and 38. Accordingly, rejection of claim 37 and 38 should be withdrawn.

H. Claim 43

Claim 43 depend from claim 42 which recites that the substrate comprising second dense circuit device. Claim 43 further recites that the substrate (second dense circuit device) and the first dense circuit device are separated by a space having conductive vias enabling electrical communication between the second dense circuit device and the first dense circuit device.

Neither Eichelberger nor Tong, alone or in combination, disclose or suggest the method of claim 43 wherein the substrate (second dense circuit device) and the first dense circuit device are separated by a space having conductive via enabling electrical communication between the second dense circuit device and the first dense circuit device. In the annotated Figure 13C relied upon by the Office Action to reject claim 43, the Office Action points to a "spacer" and a "conductive via."

However, the "spacer" pointed to by the Office Action is actually a void or space between module 800 and circuit board 1300. As known to those of ordinary skill in the art, a spacer is something that creates a space, not the void or space itself.

Moreover, the portion of the circuit board 1300 of Eichelberger characterized as the "conductive via" by the Office Action does not provide electrical communication between circuit board 1300 (characterized by the Office Action has the second dense circuit device) and the top layers of model 800 (characterized by the Office Action as the first dense circuit device). In contrast, the "conductive via" pointed to by the Office Action merely extends through circuit board 1300. Accordingly, the rejection of claim 43 should be withdrawn for least this additional reason.

VII. Rejection of Claims 44-48 under 35 USC 103(a) Based upon Eichelberger and Tong

Section 12 of the Office Action rejected claims 44-48 under 35 USC 103(a) as being unpatentable over Eichelberger et al. US Patent 6555908 in view of Tong et al. US Patent 6962835. For the reasons that follow, such rejections should be withdrawn.

A. Claim 44

Claim 44 recites a method which involves a dense circuit device, a spacer substrate and a clamping substrate. Claim 44 recites that they surface of the spacer substrate is covalently bonded to a surface of one of a dense circuit device or the clamping substrate. An interconnect is oriented between the dense circuit device and the clamping substrate. Another surface of the spacer substrate is then covalently bonded to a surface of the other of the dense circuit device and the clamping substrate to mechanically clamp the interconnect to the dense circuit device.

Neither Eichelberger nor Tong, alone or in combination, disclose or suggest the method of claim 44. It is clear that Eichelberger does not disclose a spacer substrate having one surface covalently bonded to a dense circuit device and another surface covalently bonded to a clamping substrate such that the clamping substrate and the dense circuit device mechanically clamp an interconnect therebetween. In fact, the Examiner's annotation of Figure 13B places the alleged spacer substrate completely out of contact with the alleged clamping substrate. The Examiner's "interconnect" spaces the elamping substrate from the alleged spacer substrate. Thus, the Examiner's own annotations, however distorted, do not even meet the limitations of claim 44.

Even assuming, arguendo, that it would be obvious to use so as to mechanically clamp an interconnect to a dense circuit device, as alleged to be taught by Tong in the arrangement of Eichelberger, this would merely result in module 1000 being covalently bonded to circuit board 1300. No suggestion exists for alternatively breaking up the unitary multilayer module 1000 into distinct components (a dense circuit device and an interconnect) and then covalently bonding the components together. Such a modification would clearly destroy the intended functioning in principle of operation of Eichelberger. (See MPEP 2143.01). Accordingly, the rejection of claim 44 should be withdrawn. The rejection of claims 45-48 which depend from claim 44 should be withdrawn for least the same reasons.

B. Claim 46

Claim 46 depend from claim 44 and recites that the dense circuit device comprises a dimension of less than or about 25 mm.

Neither Eichelberger nor Tong, alone or in combination, disclose or suggest a denser device and even mention of less than or about 25 mm. As before, the Office Action attempts to fill the clear inadequacy of Eichelberger end of Tong by making the assertion that because the drawings are "not to scale" this somehow discloses the claimed dimensional range. This clearly does not establish a prima facie case of obviousness. The Examiner has not met his burden. Accordingly, rejection of claim 44 is improper and should be withdrawn.

C. Claim 48

Claim 48 depend from claim 47 and recites that the interconnect comprises two sets of wires.

Once again, electrically conductive layers of a unitary multilayer module are not wires. Accordingly, the rejection of claim 48 should be withdrawn.

VIII. Rejection of Claims 49-55 under 35 USC 103(a) Based upon Hedler and Tong

Section 13 of the Office Action rejected claims 49-55 under 35 USC 103(a) as being unpatentable over Hedler et al. US Patent 6936928 in view of Tong et al. US Patent 6962835 claim 50 is canceled with its limitations incorporated into claim 49. Claims 49 and 51-55, as amended come overcome the rejection.

A. Claim 49

Claim 49 is amended to incorporate the limitations of former claim 50. Claim 49, as amended, recites orienting a projection on a dense circuit device in a depression in an interconnect and covalently bonding the projection to the interconnect.

Neither Hedler nor Tong, alone or in combination, disclose or suggest inserting or positioning or orienting a projection on a dense circuit device IN a depression in an interconnect and then covalently bonding a surface of the projection to a surface in the depression. In rejecting former claim 50, the Office Action attempts to rely upon annotated Figures 2, 3 and 4 of

Hedler. However, in such annotated figures, the Office Action points for the same structure as constituting BOTH the depression and the projection. Nowhere does the Office action point to any structure wherein a projection is IN a depression and wherein a surface of the projection is covalently bonded to surface IN the depression. Accordingly, claim 49, as amended, overcomes the rejection. Claims 51-55 depend from claim 49 and overcome the rejection for the same reasons.

B. Claims 52 and 55

Claim 52 depends from claim 49 and recites that orienting comprises orienting electrical bond pads of the dense circuit device with wires of the interconnect. Claim 55 recites that wires of the interconnect are mechanically bonded with electrical bond pads of the dense circuit device. Neither Hedler nor Tong discloses any such wires. Accordingly, rejection of claims 52 and 55 should be withdrawn for at least this additional reason.

C. Claim 53

Claim 53 depends from claim 52 and recites that the dense circuit device has a link the width of less than or equal to about 25 μm and of the electrical bond pads or the wires are less than 1 μm in breadth. As noted in the present application, one of the problems being solved by the present method is the usual difficulty of forming interconnections when dense circuit devices and the electrical bond pads become small. (See Paragraph [0003]). Applicants' method addresses the noted problem, potentially enabling more compact or smaller arrangement of devices to be achieved.

Neither Hedler nor Tong discloses the recited dimensions for the maximum size of the dense circuit device, the electrical bond pads or the wires. In rejecting claim 53, the Office Action points to structures in the annotated Figure 3 of Hedler with the notation "not to scale." This does not establish a prima facie case of obviousness with regard to a claim dimension. If such were the case, nearly every patent claim reciting a dimension would be invalid. The

rejection of claim 53 as being unpatentable over Hedler and Tong is improper and should be withdrawn.

IX. Conclusion

After amending the claims as set forth above, claims 1-21, 25-49 and 51-55 are now pending in this application.

Applicants believe that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 08-2025. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 08-2025. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 08-2025.

Respectfully submitted,

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By Todd A. Rathe

RATHE PATENT & IP LAW
Customer No. 22879
Telephone: (262) 478-9353
Facsimile: (262) 238-1469

Todd A. Rathe
Attorney for Applicant
Registration No. 38,276